When grading your own practice exams…

It is assumed you understand the following list of items mentioned during lectures and/or in the workbook solutions.
When grading your practice exams, look over these items as well.
Losing a few "ticky tack" points here and there can eventually add up to the loss of a letter grade.

1) If I ask a question such as "Determine the units appropriate for the constant k."
   If the answer is $[k] = \frac{\mathrm{m}}{\mathrm{s}}$, your answer must include those rectangular brackets.
   There is a distinction between "the *units* of k" and "the *parameter* k (which has a numerical value AND units)".

2) Unless otherwise specified in a problem statement, you are *not* required to pay attention to sig fig rules.
   a. Generally speaking your answers should be written with *three* sig figs.
   b. Exception: if the first digit of a number is a 1, you may write *four* sig figs (engineers *should* do this).
      i. Example: Suppose the final output of your calculator gave a result of $19.68723\ \mathrm{m}$.
         Acceptable ways of writing this answer include $19.7\ \mathrm{m}$ *or* $19.69\ \mathrm{m}$.
   c. In Jorstad's classes: I usually include an extra digit but also indicate the rounding column with an underbar.
      i. Example: Suppose the final output of your calculator gave a result of $3.45678\,\frac{\mathrm{m}}{\mathrm{s}}$.
         Acceptable ways of writing this answer include $3.46\,\frac{\mathrm{m}}{\mathrm{s}}$ *or* $3.4\underline{5}7\,\frac{\mathrm{m}}{\mathrm{s}}$.

3) Avoid intermediate rounding errors. Keep an extra digit on all intermediate numerical results. If your final answer differs from mine in the third digit, you will likely lose points. This is the reasoning behind using the underbar when writing results (i.e. $3.4\underline{5}7\,\frac{\mathrm{m}}{\mathrm{s}}$).

4) Most of the time, numerical results should include units. There are some numerical quantities in physics (i.e. the coefficient of friction) which have no units. That said, any time you write a down a numerical result, double check if units were included in the problem statement. Missing units on a result will always cost you points.

5) Do NOT write units after purely algebraic answers (i.e. $v = \sqrt{2gh}$ **is ok** but $v = \sqrt{2gh}\ \frac{\mathrm{m}}{\mathrm{s}}$ **is wrong**).
   Think about it: the parameters $h = 22.2\ \mathrm{m}$ and $g = 9.8\,\frac{\mathrm{m}}{\mathrm{s}^2}$ already include units.

6) Sometimes results will include both numerical values and algebraic variables.
   In these instances, include appropriate units on numerical parameters but do not include units on variables.
   For example: suppose you found a result for position as a function of time shown below.
   Notice the numerical terms include units. Upon plugging in time $t = 5.55\ \mathrm{s}$ the units will work out!

$$x(t) = \left(2.22\,\frac{\mathrm{m}}{\mathrm{s}^2}\right)t^2 + \left(3.33\,\frac{\mathrm{m}}{\mathrm{s}}\right)t + 4.44\ \mathrm{m}$$

7) Drawing sketches of 2D vector problems (*approximately* to scale) can be very enlightening.
   If you cannot draw the sketch, odds are you do not really understand the problem.
   Tip: draw an initial sketch based on how you interpret the problem statement.
   After getting your results, revise your initial sketch and see if things seem plausible.

8) Many results in physics deal with vector quantities (i.e. force, velocity, acceleration, etc).

a. **Vectors** can be written in polar form or Cartesian form

i. Example: $\vec{v} = 20.0\,\frac{\text{m}}{\text{s}}$ @ 36.9° N of W **OR** $\vec{v} = (-16.0\hat{\imath} + 12.0\hat{\jmath})\,\frac{\text{m}}{\text{s}}$.

ii. Notice both units and $\hat{\imath}$ & $\hat{\jmath}$ are included on the vector in Cartesian form.

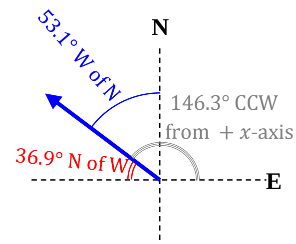
iii. Another acceptable style for Cartesian vectors is $\vec{v} = <-16.0,\ 12.0, 0>\frac{\text{m}}{\text{s}}$. Still need units!

b. **Vector *magnitudes*** correspond to the size of a vector (no direction should be included).

i. Example: $v = \|\vec{v}\| = \sqrt{v_x^2 + v_y^2 + v_z^2} = 20.0\,\frac{\text{m}}{\text{s}}$.

ii. Notice units are included but we no longer include any $\hat{\imath}$ or $\hat{\jmath}$.

iii. A vector magnitude should always be a positive result.



c. **Vector *directions*** correspond to the direction a vector points.

i. *In 2D*, sketch a picture and label ONE angle (see figure at right).

ii. Three possible correct styles for writing the angle are shown at right.

iii. Include units of degrees (or radians) as appropriate.

iv. *In 3D*, determine a unit vector (see next bullet).

d. **Unit vectors** are often used to specify vector *direction*.

i. A worked example is shown below.

ii. Notice the *hat* symbol is used for a units vector (versus an *arrow* for the full vector).

iii. Units vectors always include $\hat{\imath}$ & $\hat{\jmath}$ but *never* include units (they cancel out in the computation)!

iv. Example:

$$\hat{v} = \frac{\vec{v}}{v}$$

$$\hat{v} = \frac{(-16.0\hat{\imath} + 12.0\hat{\jmath})\,\frac{\text{m}}{\text{s}}}{20.0\,\frac{\text{m}}{\text{s}}}$$

$$\boldsymbol{\hat{v} = -0.800\hat{\imath} + 0.600\hat{\jmath}}$$

9) There are two types ways to multiply vectors

a. The **dot product** relates to how *parallel* two vectors are.

i. A *dot* product is written $\vec{A} \cdot \vec{B}$ (use a bullet, not the times symbol).

ii. The output of a *dot* product *may* include units (if the input vectors have units).

iii. The output of a *dot* product never includes $\hat{\imath}$ or $\hat{\jmath}$ (the output of a *dot* product is a *scalar*).

iv. The output of a *dot* product is zero if two vectors are *perpendicular*.

b. The **cross product** relates to how *perpendicular* two vectors are.

i. A *cross* product is written $\vec{A} \times \vec{B}$ (use the times symbol, not a bullet).

ii. The output of a *cross* product *may* include units (if the input vectors have units).

iii. The output of a *cross* product usually includes $\hat{\imath}$ or $\hat{\jmath}$ (the output of a *cross* product is a *vector*).

iv. The output of a *cross* product is zero if two vectors are *parallel*.

v. Look carefully, did a question ask for the cross product ($\vec{A} \times \vec{B}$, a *vector* result) or the *magnitude* of the cross product ($\|\vec{A} \times \vec{B}\|$, a *scalar* result).